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ABSTRACT

The Delphic Technique utilizes a survey format with multiple rounds of questionnaires, sequential statistical feedback, and respondent anonymity. The principal objective is to use expert opinion to refine predictions about the occurrence of future events. An open-ended questionnaire was sent to 200 subjects selected from the membership of the Association for Educational Communications and Technology. They were asked to identify the trends in educational media and technology they felt would be significant in the next 25 years. Four rounds of questionnaires were generated and analyzed. From the results it is difficult to derive substantive information concerning the future of educational media and technology. Opinion converged toward the view that hardware trends are more likely to occur, and software trends are more important. The technique and the results obtained had many limitations which were noted. (CH)

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A Delphic Exploration of the Future of Educational Media

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A Delphic Exploration of the Future of Educational Media

What do you think about when you hear the words "prediction" or "forecast"? Perhaps the weather? The weatherman has a pretty good record for short-term prediction; there is a great deal of past experience to work with, and weather patterns can be traced across the country. Most other common forms of prediction have not developed the track record that is required for confidence among natural skeptics. I am a skeptic too! There has been a recent awakening of interest in "technological forecasting", predicting the trends in technological development in the short and long-term future. The science is still much too young for us to point out any really substantive evidence of success. Forecasting has remained a marginal science at best, and it is still an activity which most scientists tend to tolerate with a jaundiced eye.

Most technological forecasting has developed since 1960, and has been utilized almost entirely by business and government interests. Most often businesses follow the philosophy, "Why not try it; it can only help us." It has been this healthy venturesomeness in the business community that has assured their success. Nothing ventured, nothing gained! In education, our philosophy has been somewhat different. Education is among the most conservative areas of human endeavor. Innovations have spread, but usually slowly and as part of a "bandwagon effect". Rarely, if ever, have educators been the change agents in our society. More often than not, it has been the business community that has dictated the course of educational innovations.

The thesis of this paper is that educators, and particularly educational technologists, must begin taking a more direct responsibility for their own future. As long as technological development continues to be haphazard and makeshift, there can be no hope for solving some of the key problems in education. There are currently a few pockets of experimentation with educational futures and futures methodology, but little of this concern has spread to the educational mainstream. This paper will briefly describe one attempt at experimenting with the Delphi Technique in forecasting future developments in educational media and technology.

The Delphi Technique, developed by researchers at the Rand Corporation, utilizes a survey format with multiple rounds, sequential statistical feedback, and respondent anonymity. The principal objective of the technique is to use expert opinion to refine predictions about the occurrence of future events. It is assumed that the multiple round format will give experts an opportunity to rethink their forecasts on the basis of statistical feedback from other experts. The use of the survey format, with anonymity assured, was proposed to eliminate the potential negative effects of face-to-face group deliberation, including the effects of group-related artifacts such as differential status and face saving. The Delphi allows experts to deliberate independently without the contaminating effects of "group dynamics". This technique has been used extensively in technological forecasting for approximately a decade, however its most frequent use as a long-term forecasting tool still precludes substantive evidence of efficacy.

Procedures

This study used a procedure common to Delphi studies. An open-ended questionnaire was sent to two hundred prospective respondents, selected by stratified random sampling (for geographical representation) from the membership directory of the Association for Educational Communications and Technology. Those contacted were asked to "nominate" the trends in the field of educational media and technology which they felt would be the most significant in the next twenty-five years. Return of the first round questionnaire was assumed to indicate agreement to participate in subsequent rounds of the survey.

One hundred first round questionnaires were returned. Responses were content-analyzed in order to determine unique trends which would form the basis of subsequent rounds of the survey. Sixty-eight trends were enumerated. These were sent back to respondents who were asked to rate each trend for importance, predicted increase, and the certainty of their prediction. This information was analyzed and mean scores were computed. The mean scores were sent back to respondents along with the second round of the survey. Due to some misunderstandings with the response categories used in the first round, categories were revised slightly to importance and probability of occurrence. The original three response categories for each item proved confusing and the "certainty of prediction" category, which was intended to weight respondent's self-perceived expertise, did not seem to communicate as intended. Respondents rated each trend on a five-point Likert-type scale, with "1" representing "high" and "5" representing "low", in terms of importance and probability of occurrence. In the third round, trends were further consolidated into fifty-isx items in order to eliminate remaining ambiguities.

Third round responses were received and mean scores were again computed. These mean scores were sent back to respondents along with the fourth and final round of the survey. Respondents were also asked to comment upon the survey and make suggestions for future use of the Delphi Irstrument. The same questionnaire was used for the fourth round as had been used in the third round. The results of the survey were then tabulated and a final report was written and returned to all survey participants.

These procedures differed from the standard Delphi model in several ways. First, the questions asked were unusual for Delphi studies. Usually, respondents are asked to predict a certain year of technological innovation or a specific cost estimate. Although this type of question is probably better designed for the Delphi procedure, it did not seem like the type of question that would be most beneficial in these early stages of methodological study. Second, mean scores were used instead of medians for statistical feedback, due to their appropriateness for the type of data requested from respondents. Inter-quartile ranges are usually also computed, but were deemed inappropriate feedback in this study (variances were used in the final report to indicate convergence of opinions). Finally, additional feedback, such as reasons for extreme positions, was omitted in this study, due to time constraints and anticipated confusion. In the future a more orthodox study might prove helpful by way of comparison.

Results

The results of this study are difficult to interpret in terms of neat and clear-cut generalizations. Obviously, as can be seen from the accompanying tables, different items seem to react differently through the course of the survey. As a result, it is difficult to derive substantive information concerning the future of educational media and technology. What we can see is a convergence of opinion for most items, as demonstrated by the narrowing of the response variance. What we can deduce from this information is that the Delphi seems to be doing what it is supposed to do. In general, "software" and "process" trends appear to be more volatile from round to round than "hardware" trends. In addition, "software" trends appear to be viewed as more important. Conversely, "hardware" trends appear to be considered by respondents as more likely to occur. The main limitation of this study seems to be the difficulty in interpreting the response scales as provided. For example, what does a mean score of "2.05" really mean? Obviously, in the future, more care must be taken in developing questions are scales that will be more easily interpreted.

Characteristics of Respondents

Geographical Distribution:

Northeast	27
Midwest	24
South	18
West	31
	100

Occupational Distribution:

College & university faculty	27
Higher education media centers	35
School media centers	17
Government	3
Research centers	3
Private enterprise	10
Higher education administrators	5
	100

Some Possible Limitations of this Study

It is virtually impossible to specify all the factors that have imposed limitations on this study. However, it is perhaps the most valuable outcome of any exploratory investigation to view the faulty assumptions and errors, the correction of which might facilitate subsequent efforts. The following are some of the major limitations which might have acted upon this study, most of which are stated as research questions:

1. How can one isolate specific trends in Educational Media from the other societal trends that might give rise to them and constrain them?

2. Can we expect reliable results when most respondents have had little experience in thinking systematically about the long-term future?

3. Can we expect educators to think about the future when there seems to be so little control possible over events?

4. Educators probably are, on the average, quite conservative in their approach to the unknown.

5. This survey stretched over a period of more than six months, which could have had a profound effect on responses.

6. Was lack of interest and respondent mortality over time a significant factor in this study?

7. Are we prone to think of the future in a unidimensional and undynamic way?

8. The Delphi Technique has been most effective for specific predictions, such as cost and diffusion time of innovations. Is general prediction a valid use of the technique?

9. Should respondents have had previous experience with the technique and more explicit understanding of the process?

10. How serious was the problem of differential interpretation of trends and response categories?

11. Is there a danger in using techniques like the Delphi before we fully understand their value for education?

12. Should respondents have had more opportunity to comment during the process and add, subtract, and ammend questionnaire items?

13. As unpaid volunteer respondents, how much time was actually spent in considering and reviewing responses?

14. Should there have been some differential weighting system in order to consider the individual strengths and weaknesses of respondents?

15. Is there really an audience for such predictive activities today?

16. Can we expect respondents to predict software developments as easily as hardware developments?

17. Should we not think of the ramifications of these trends as well?

Representative Comments and Suggestions by Respondents

1. Some terms were ambiguous and too general. A number of terms, e.g. holography, could have benefited from definition and explanation.

2. Many items are interrelated and yet treated as being discrete trends.

3. Many items seem to overlap.

4. Some items are prerequisite to responses to other items, e.g. teacher education.

5. Some items depend on external forces which are difficult or impossible to predict, e.g. government actions.

6. There was a problem of reconciling one's own feelings with the feelings of the majority, as the technique requires.

7. There was a probable lack of consistency in considerations that influence responses, such as "cost," "feasibility," etc.

8. There were too many rounds to the survey, and interest tended to wane.

9. Items should have been grouped into categories of similar types throughout the survey.

10. What is the survey measuring? Attitudes?

11. There is the problem of differential experience while the survey is in progress.

12. There should be encouragement for respondents to use the full range of responses.

13. There is the problem of "response sets."

14. Does it matter that different respondents interpret items differently?

15. Some questions seemed biased.

16. Why not ask which trends are most "unimportant" and "improbable"?

17. There was a general feeling that respondents lacked expertise as authorities and as futurists.

18. When respondents rated the importance as high and the probability as low, there should be supplementary comments.

19. In any case, there should be a column for additional comments for each item.

20. There is the difficulty of quantifying according to the response categories.

Conclusions

The value of prediction is probably subject to little doubt. Doubt arises from the effectiveness of the technique, procedures, and personnel employed. In education this is a particularly difficult problem, for there is a lack of venturesomeness, a "present orientation", and the lack of proven methodologies for attacking the problem. There is a long way to go before we will be able to have confidence in thinking about the future; but, it is time to start thinking about it. Although many view surveys as a nuisance, they can be a valuable and relatively inexpensive way to go, especially if we learn from the experiences and mistakes of others.

Before we can have confidence in prediction, the following steps will probably be required:

1. "Future thinking" will have to be taught and accepted as being legitimate as past and present thinking.

2. There should be greater understanding of the interrelatedness of social processes and methods for assessing the probable effects of social changes on other related institutions.

3. There should be a development of methods for planning future events in education and the power to carry them out.

4. There should be money available to pay consultants to think about the future in their areas of expertise.

5. There should be cooperation between organizations and industries involved in educational futures.

6. We must not limit our thinking to hardware and observables only.

7. Techniques must be developed for future thinking which have the confidence of all concerned.

8. There should be regular conferences aimed at exploring the nature and social ramifications of educational change.

9. There should be a recognition that educational planning is socially desirable.

10. We shold develop dynamic, not static, models and methods of prediction.

11. There is a need for collaborative research and investigation among educators and other social scientists.

Hopefully the present study has provided a valuable preliminary step in our investigations of our educational future. Certainly it is flawed. Probably the year 2000 will bring us far more than just the continuation of current trends or their demise. The major question seems to be whether we can choose the educational media and technologies that are optimal and plan for them. There is little doubt that such thinking will require a different perspective than we currently use.

This current study may be more valuable in exposing our myopia than in providing a reliable view of educational futures. It also may provide us with a list of priorities and important research questions. If there is a substantive value to the data, it is probably the ranking of the trends according to respondents' perceptions of their relative importance. This might help us focus in on specific areas of investigation with more confidence. Such futures studies are still more important as a process than as a product. The future can be our friend or worst enemy, depending on how we view it and on how well we can plan. In education with our continually shrinking resources, planning for the future is a necessity.

Trend	Second Round				Third Round				Fourth Round			
	Pred. Inc.		Importance		Importance		Prob. Occ.		Importance		Prob. Occ.	
	Mean	Var.	Mean	Var.	Mean	Var.	Mean	Var.	Mean	Var.	Mean	Var.
More emphasis on software	2.01	.97	1.54	1.11	1.50	.76	2.05	.71	1.36	.65	2.32	1.19
More media emphasis in teacher training	2.14	1.31	1.64	1.13	1.64	.62	2.13	.81	1.56	.70	2.49	.70
More materials validation	2.11	1.01	1.71	.84	1.61	.53	2.14	.92	1.80	1.17	2.59	.76
More acceptance of media	2.00	.82	1.72	1.13	1.44	.54	1.95	1.03	1 39	.48	2.36	0.79
More specific applications of media	2.10	1.92	1.76	1.10	1.55	.89	2.03	1.16	1.44	.73	2.22	.83
Improved evaluation	2.03	1.25	1.78	1.21	1.53	.63	2.08	.80	1.59	.83	2.41	.63
More concern with motivation	2.19	1.02	1.80	.92	1.70	.69	2.27	.71	1.80	.89	2.46	.80
More efficient delivery systems	2.08	1.85	1.82	1.02	1.83	.75	2.22	.90	1.88	.03	2.36	.72
More proof of media effectiveness	2.25	1.16	1.85	1.16	1.97	1.21	2.38	1.00	1.81	1.02	2.53	.74
Lifelong education	2.07	1.49	1.85	1.38	1.66	.89	2.16	1.21	1.80	1.17	2.36	.75
More alternative learning environments	2.17	1.44	1.86	1.19	1.81	.92	2.19	.98	2.03	1.17	2.49	.70
Hardware miniaturization	2.26	1.59	1.88	1.75	2.28	1.00	1.77	.85	2.49	1.25	1.93	1.06
More prescriptive education	2.58	1.56	1.89	1.66	2.19	.85	2.47	.95	2.09	.91	2.61	.76
More research with interactions of variables	2.17	1.85	1.92	1.63	1.92	1.06	2.36	1.19	1.96	1.03	2.56	.77
More media resource sharing	2.41	2.34	1.96	1.52	1.97	1.89	2.38	.97	1.85	.99	2.86	1.26
More funding for specific media application	2.74	1.51	1.97	1.21	1.98	1.06	2.78	1.60	1.85	.72	3.07	.96
Increased accountability	2.20	1.22	2.00	1.13	1.72	.59	2.08	.77	1.85	1.06	2.44	1.01
Comprehesive copyright legislation	2.38	1.94	2.01	1.72	1.83	.78	2.36	1.57	1.93	1.13	2.49	1.39
Improved cable video	2.03	1.40	2.03	1.19	2.36	1.28	2.20	1.18	2.39	1.21	2.25	1.06
More home media use	2.21	1.15	2.03	1.08	2.14	1.08	1.98	.87	2.29	1.14	2.42	.87

Trend	Second Round				Third Round				Fourth Round			
	Pred. Inc.		Importance		Importance		Prob. Occ.		Importance		Prob. Occ.	
	Mean	Var.	Mean	Var.	Mean	Var.	Mean	Var.	Mean	Var.	Mean	Var.
More varied programing	2.41	1.65	2.04	1.24	1.95	.90	2.20	.99	2.15	.89	2.44	.84
More video cassette use	1.86	1.29	2.04	1.33	2.02	.97	1.81	.82	2.09	.91	1.98	.81
More student production	2.30	1.37	2.05	1.57	2.03	1.08	1.97	.92	2.15	.99	2.31	.73
Unification of library and media services	2.07	1.25	2.06	1.86	2.03	1.33	2.25	1.39	2.24	1.46	2.51	1.29
Teacher as manager of learning resources	2.62	1.23	2.06	1.01	1.81	.82	2.50	.92	1.78	.79	2.75	1.19
More humanistic orientations	2.77	1.31	2.06	1.27	1.89	1.02	2.64	1.16	1.01	1.12	2.58	.87
More emphasis on visual learning	2.34	1.14	2.07	.97	2.11	.83	2.30	.83	1.97	.62	2.46	.56
More competency-based instruction	2.18	.94	2.09	1.16	1.89	.96	2.08	.84	2.02	.57	2.41	.63
More concern with affective domain	2.48	1.27	2.09	1.31	1.81	.85	2.31	.92	1.98	.67	2.64	.51
More vocational emphasis	2.03	1.24	2.13	1.11	1.88	1.85	1.93	.79	1.89	.96	1.92	.73
Improved satellite systems	1.88	1.40	2.14	1.48	2.50	1.33	1.95	1.00	2.44	1.25	2.14	1.12
More concern for futures	2.40	1.83	2.15	1.50	2.02	.97	2.28	.97	2.03	.99	2.61	1.17
Clearer standards for media programs	2.57	1.19	2.17	1.17	2.16	1.06	2.41	.98	2.15	.93	2.64	1.06
Increased computerized information retrieval	2.24	1.52	2.20	1.47	2.09	1.01	2.22	1.00	2.12	.66	2.51	.91
Computer/video interface	2.12	1.23	2.22	1.51	2.28	1.19	2.11	1.15	2.25	.75	2.46	1.05
More external degree programs	2.08	1.35	2.22	1.63	2.29	1.23	2.03	.89	2.20	.85	2.37	1.03
Integration of educational and leisure activities	2.41	2.35	2.22	1.57	2.29	1.01	2.34	1.02	2.31	1.18	2.93	.98
Improved feedback systems	2.64	1.36	2.23	1.47	2.20	1.15	2.36	1.25	2.42	1.04	2.66	.81
More sophisticated uses of videotape recording	1.99	1.19	2.23	1.50	2.29	.94	2.20	.86	2.37	.93	2.41	.83
Video disc technology	2.11	1.56	2.27	1.81	2.19	1.33	1.84	1.21	2.03	.72	1.95	.95
Improved graphic computer terminals	2.17	1.54	2.28	1.65	2.42	1.11	2.08	1.18	2.48	.53	2.20	.68

Trend	Second Round				Third Round				Fourth Round			
	Pred. Inc.		Importance		Importance		Prob. Occ.		Importance		Prob. Occ.	
	Mean	Var.	Mean	Var.	Mean	Var.	Mean	Var.	Mean	Var.	Mean	Var.
More cost-effective computer assisted instruction	2.24	1.64	2.29	1.58	2.22	1.54	2.30	1.23	2.27	.96	2.71	1.24
Fewer media formats	2.87	2.66	2.29	1.96	2.69	1.55	3.09	1.77	2.73	1.48	3.59	.97
Growth of regional media centers	2.40	1.10	2.29	1.33	2.11	1.24	2.27	1.25	2.29	.97	2.63	1.03
Computer terminals in homes	2.65	2.08	2.32	1.30	2.72	1.63	2.69	1.65	3.00	1.38	3.20	1.72
Plug-in Plug-out mass education	2.29	1.84	2.39	2.16	2.33	2.26	2.55	1.97	2.90	1.75	2.97	1.76
Production consortiums	2.41	1.58	2.41	1.72	2.39	1.32	2.69	1.43	2.42	1.11	2.86	.91
Portable microfiche readers for mass use	2.32	1.62	2.46	1.74	2.28	1.41	2.20	1.56	2.49	1.12	2.53	1.22
More instructional development	2.04	1.11	2.49	1.23	1.61	.81	2.19	1.11	1.66	1.02	2.34	.92
World-wide educational television	2.75	1.19	2.49	1.81	2.59	1.61	2.69	1.39	2.70	1.35	2.92	1.04
More efficient computer managed instruction	2.18	1.76	2.63	1.80	2.55	1.11	2.58	1.11	2.31	.91	2.76	.98
Cognitive mapping	2.89	2.19	2.66	2.00	2.33	1.40	2.44	1.39	2.46	1.32	2.53	.98
Computerized media distribution	2.22	1.59	2.69	2.24	2.42	1.20	2.36	1.38	2.36	.85	2.66	.99
Biofeedback techniques	2.74	2.34	2.70	2.19	2.47	1.87	2.48	2.16	2.66	.88	2.71	1.17
More non-certificated media personnel	2.67	1.94	2.72	2.01	2.52	1.78	2.08	1.53	2.78	1.45	2.61	1.45
Holographic technology	2.70	2.37	2.84	2.54	2.64	1.79	2.27	1.44	2.68	1.08	2.46	1.08